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(54) **A DEVICE FOR PREVENTING INTERNAL COMBUSTION FROM DEVELOPING OUTWARDS**

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(56) References cited:
WO-A-2005/089878 CN-A- 1 560 636
CN-Y- 2 717 085 JP-A- 07 233 981
US-A- 4 719 973 US-A- 5 079 542
US-A- 6 072 397

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EP 1 950 860 B1

Description**Field of the Invention**

5 **[0001]** The present invention relates to the technical field of overheat protection, and in particular to a device for preventing internal combustion of equipment from spreading outwards.

Background of the Invention

10 **[0002]** When internal combustion of an equipment is caused by internal short circuits or other reasons, effective measures need to be taken to prevent flames from spreading to the outside of the equipment so as to avoid unnecessary risks. Conventional practice is to connect a thermal fuse in a power supply circuit of a cooling fan of the equipment in series. While internal combustion of the equipment is happening, internal temperature is high enough to melt the thermal fuse so as to turn off the cooling fan. One effect is to prevent air convection caused by continuous work of the fan, reduce
15 supply of internal oxygen and make the combustion not continue any longer. Another effect is to prevent the fan from blowing flames out of the equipment and causing objects around to be burnt.

[0003] As shown in Figure 1, which is a diagram illustrating a regularly adopted solution for overheat protection circuit in the prior art, the working mechanism is to connect a thermal fuse into the power supply circuit of a monitored unit in series. Thermal fuses F1, F2 are melted to cut off the power supply of the monitored unit when the temperature is high
20 enough to avoid the harms caused by overheat. The aim of using the parallel connection design of the thermal fuses F1, F2 is to prevent mis-operation caused by failure of one of the thermal fuses. The thermal fuses are made into a small module and installed on a structure supporting frame of equipment via wires. The monitored unit shown in the figure is a fan.

[0004] In the solution of the prior art, due to lack of any automatic detecting measure to report the failure of the thermal fuse and reminding a maintainer for timely replacement when one of the thermal fuses fails due to other reasons (for
25 example, fails during production welding), a fan may be turned off incorrectly if other thermal fuses also fail because of other reasons except over temperature (for example, a failure of aging). This may result in a quite high internal temperature without cooling by the fan and cause damage to the equipment. Furthermore, a service may be abnormal or even collapse. Therefore, the solution shown in Figure 1 has poor maintainability and testability. In addition, the thermal fuse monitors the power supply of the fan which is strong power. The thermal fuse module is regularly installed on the structure
30 support of the equipment and the support is connected to a protection ground (PGND) of the equipment. Therefore, there are safety specification requirements on the wires of the power supply and the PGND of the support. At the same time, shell and pins of some thermal fuses are equipotential. In other words, the housing and the power supply are also equipotential when the pins of the thermal fuse are connected to the power supply. Therefore, there are safety specification requirements on the shell of the thermal fuses and the PGND of the structure element of the equipment. A short circuit
35 between the PGND and the power supply may be easily caused in the case of improper processing.

 In addition, US 6 072 397 discloses a method and apparatus which reduces flame emissions from an electronic in the event of a fire within the enclosure. At least one fan is utilized to provide air flow along an air flow path between an air intake port and an air exhaust port of the enclosure. At least one heat sensor, such as a linear heat detector cable, detects an over-temperature condition within air flow path when the temperature in the air flow path exceeds a prede-
40 termined threshold temperature. The sensors are coupled to a fan controller. In response to the detection by the controller of the over-temperature condition indicated by one or multiple sensors disposed within the air flow path, the fan are disabled to avoid the fanning of flames within the enclosure and the exhaust of flames from the enclosure. The controller may also activate an indicator such as an alarm or warning light to make a user aware of over temperature condition and additionally may provide an electronic signal indicative of the over-temperature condition to system hardware or
45 software to permit further alert messages to be provided.

 US 5079542 disclosed an abnormal temperature detector for an electronic apparatus includes a plurality of temperature detectors, an abnormality detector, and a power supply controller. The plurality of temperature detectors are arranged at least at one detection point of a
50 rack, of an electronic apparatus, in which a plurality of wiring boards having IC elements mounted thereon are housed, and respectively output detection outputs when a temperature at the detection point becomes a present temperature or more. The abnormality detector detects that detection output are output from all the temperature detectors at the detection point. The power supply controller interrupts a power supply of the apparatus in response to an abnormality detection output from the abnormality detector.

 WO 2005 / 087898A provides a method and device for managing the ventilation device in the electronic apparatus, the core thereof is that manage the operation states of the ventilation device in the electronic apparatus according to the
55 temperature within the electronic apparatus. When electronic apparatus is on fire, the loss of fire to the least.

Summary of the Invention

[0005] The present invention provides two devices for preventing internal combustion of equipment from spreading outwards. The device is not only provided with function of alarm and monitoring the power supply, but also may avoid the safety specs problem.

[0006] Technical solutions of the present invention include:

[0007] a device for preventing internal combustion of equipment from spreading outwards including a sampling circuit, a detecting and monitoring circuit connected to the sampling circuit and a low-voltage datum power supply; the output of the low-voltage datum power supply is connected to the ground via the sampling circuit to form a loop circuit;

[0008] the sampling circuit includes at least two thermal detectors, the detecting and monitoring circuit includes a first monitoring output end out1 and a second monitoring output end out2, and the detecting and monitoring circuit monitors the output of the first monitoring output end out1 and the second monitoring output end out2 according to the status of the thermal detectors as follows:

[0009] the first monitoring output Vout1 is inactive and the second monitoring output Vout2 is inactive when the at least two thermal detectors are in normal state;

[0010] the first monitoring output Vout1 is inactive and the second monitoring output Vout2 is active when some of the at least two thermal detectors are in abnormal state;

[0011] the first monitoring output Vout1 is active and the second monitoring output Vout2 is active when the at least two thermal detectors are all in abnormal state;

[0012] the first monitoring output Vout1 is configured to turn off a power supply, and the second monitoring output Vout2 is configured to drive an alarm unit.

[0013] One preferable embodiment of the present invention is that:

[0014] the sampling circuit includes a first thermal detector F1, a second thermal detector F2, a first resistor R1, a second resistor R2, a third resistor R3 and a fourth resistor R4;

[0015] the first thermal detector F1 and the first resistor R1 are connected in series to form a first branch circuit,

[0016] the second thermal detector F2 and the fourth resistor R4 are connected in series to form a second branch circuit, the first branch circuit and the second branch circuit are connected in parallel to form a thermal detector parallel circuit;

[0017] the thermal detector parallel circuit and the second resistor R2 and the third resistor R3 are connected in series and between the low-voltage datum power supply and the ground.

[0018] The detecting and monitoring circuit includes a first input end in1 and a second input end in2.

[0019] The first input end in1 of the detecting and monitoring circuit is connected between the thermal detector parallel circuit and the second resistor R2, the second input end in2 is connected between the second resistor R2 and the third resistor R3.

[0020] The detecting and monitoring circuit is realized by an integrated voltage comparator or a discrete voltage comparator.

[0021] Another exemplary embodiment of the present invention is that:

[0022] the sampling circuit includes a first thermal detector F1, a second thermal detector F2, a first resistor R1, a fifth resistor R2' and a fourth resistors R4;

[0023] the first thermal detector F1 and the first resistor R1 are connected in series to form a first branch circuit; the second thermal detector F2 and the fourth resistor R4 are connected in series to form a second branch circuit; the first branch circuit and the second branch circuit are connected in parallel to form a thermal detector parallel circuit;

[0024] the thermal detector parallel circuit and the fifth resistor R2' are connected in series and between the low-voltage datum power supply and the ground.

[0025] The detecting and monitoring circuit includes an analog-to-digital AD converting chip and a CPU coupled with the AD converting chip;

[0026] an input end in1 of the AD converting chip is connected between the thermal detector parallel circuit of the sampling circuit and the fifth resistor R2'; one output pin on the CPU is a first monitoring output end; another output pin on the CPU is a second monitoring output end.

[0027] The thermal detector in the sampling circuit is installed on a thermal detecting single-board. The thermal detecting single-board is installed in equipment in a manner of hot plug.

[0028] The device further includes a pull-up resistor configured to pull a mode selection signal in the detecting and monitoring circuit up to the status of power supply VCC so as to make the first monitoring output Vout1 inactive and the second monitoring output Vout2 active when the thermal detecting single-board is off-duty.

[0029] The device further includes a delay driving circuit connected after the first monitoring output end in series and configured to eliminate the status of dithering occurred during the hot plug of the thermal detecting single-board.

[0030] The thermal detector is an element whose on-off changes with the change of temperature, or an element whose resistance value changes greatly with the change of temperature.

[0031] The power supply includes but not limited to a power supply of a fan or a power supply of a system and a fan.

[0032] A device for preventing internal combustion of equipment from spreading outwards includes at least two sampling circuits, a detecting and monitoring circuit and a low-voltage datum power supply which are connected to each of the sampling circuits respectively. An output of the low-voltage datum power supply is connected to the ground via each of the sampling circuits respectively to form a loop circuit with each of the sampling circuits independently. Each of the sampling circuits includes at least two thermal detectors. The detecting and monitoring circuit includes a first monitoring output end out 1 and a second monitoring output end out2. The detecting and monitoring circuit monitors the output of the first monitoring output end out1 and the second monitoring output end out2 according to the working status of the thermal detector in each of the sampling circuits as follows:

[0033] the first monitoring output Vout1 is inactive and the second monitoring output Vout2 is inactive when the thermal detectors in the device are all in normal status;

[0034] the first monitoring output Vout1 is inactive and the second monitoring output Vout2 is active when some of the thermal detectors in the device is in abnormal status and at least one thermal detector in each of the sampling circuits is normal;

[0035] the first monitoring output Vout1 is active and the second monitoring output Vout2 is active when all the thermal detectors in at least one sampling circuit are in abnormal status.

[0036] The first monitoring output Vout1 is configured to cut off the power supply of a fan, and the second monitoring output Vout2 is configured to drive an alarm unit.

[0037] One preferable embodiment of the present invention is that:

[0038] The sampling circuit includes a first thermal detector F1, a second thermal detector F2, a first resistor R1, a fifth resistor R2' and a fourth resistors R4.

[0039] The first thermal detector F1 and the first resistor R1 are connected in series to form a first branch circuit. The second thermal detector F2 and the fourth resistor R4 are connected in series to form a second branch circuit. The first branch circuit and the second branch circuit are connected in parallel to form a thermal detector parallel circuit. The thermal detector parallel circuit and the fifth resistor R2' are connected in series and between the low-voltage datum power supply and the ground.

[0040] The detecting and monitoring circuit includes an analog-to-digital AD converting chip and a CPU coupled with the AD converting chip.

[0041] Each input end in1 of the AD converting chip is connected between the thermal detector parallel circuit of each of the sampling circuits and the fifth resistor R2' respectively, one output pin on the CPU is a first monitoring output end, another output pin on the CPU is a second monitoring output end.

[0042] The thermal detector parallel circuit is installed on a thermal detecting single-board. The thermal detecting single-board is installed in the device in a manner of hot plug.

[0043] The present invention further includes a pull-up resistor configured to pull a mode selection signal in the detecting and monitoring circuit up to the status of power supply VCC so as to make the first monitoring output Vout1 inactive and the second monitoring output Vout2 active when the thermal detecting single-board is off-duty.

[0044] The device further includes a delay driving circuit connected after the first monitoring output end in series and configured to eliminate the status of dithering occurred during the hot plug of the thermal detecting single-board.

[0045] The thermal detector is an element whose on-off changes with the change of temperature, or an element whose resistance value changes greatly with the change of temperature.

[0046] The power supply includes, but not limited to, a power supply of a fan or a power supply of a system and a fan.

[0047] With the present invention, an alarm may be reported effectively when one thermal detector on the thermal detecting single-board is abnormal. The fan of the system may not stop working because of the abnormal single-board. The maintenance may be taken timely. An alarm is reported and the power supply of the fan or the power supply of the system and the fan may be turned off when all the thermal detectors on the thermal detecting single-board are abnormal so as to prevent the internal combustion of equipment from spreading outwards and report alarm information in time for timely maintenance. Moreover, during the process of maintenance, the replacement of the thermal detecting single-board does not affect the normal work of the system so as to ensure the reliable running of the system. Safety specs problems may not be caused when a short circuit emerges between the thermal detecting single-board and the shell of the system, and elements may not be burnt out due to the short circuit.

Brief description of the Drawings:

[0048] Figure 1 is a schematic diagram illustrating a solution of the prior art;

[0049] Figure 2 is a schematic diagram illustrating a device for preventing internal combustion from spreading outwards according to a realizing manner of the present invention;

[0050] Figure 3 is a schematic diagram illustrating a device for preventing internal combustion from spreading outwards according to another realizing manner of the present invention;

[0051] Figure 4 is a schematic diagram illustrating a device for preventing internal combustion from spreading outwards according to an embodiment of the present invention;

[0052] Figure 5 is a schematic diagram illustrating a device for preventing internal combustion from spreading outwards according to another embodiment of the present invention; and

[0053] Figure 6 is a schematic diagram illustrating a device for preventing internal combustion from spreading outwards according to another embodiment of the present invention.

Detailed Description of the Embodiments

[0054] The realization idea of the present invention is to connect a thermal detector into a low voltage power supply loop circuit in series so as to avoid the safety specs problem existing in strong power wires caused by connecting the thermal detector directly to a power supply circuit of a monitored unit in series in the prior art; and achieve the aim of alarm and monitoring the power supply by a change of resistance value of the thermal detector. The thermal detector may be realized by an element whose on-off change may be caused due to the change of temperature, for example, a thermal fuse. Alternatively, the thermal detector may be realized by an element whose resistance value may greatly change caused due to the change of temperature, for example, a thermistor. Whichever element is used, the realizing principle is the same except a difference of resistance value of each voltage dividing resistor in a practical circuit. The present invention is illustrated as follows by a thermal fuse for example.

[0055] As shown in Figure 2 and Figure 3, in this realization solution, a thermal fuse is connected to a low voltage power supply loop circuit in series so as to avoid the safety specs problem existed in strong power wires caused by connecting the thermal detector directly to a power supply circuit of a monitored unit in series in the prior art. The design is as follows. A first thermal fuse F1 is connected to a first resistor R1 in series. A second thermal fuse F2 is connected to a fourth resistor R4 in series. Then they are connected in parallel to form a thermal fuse parallel circuit. The resistors R4 and R1 have the same resistance value, that is, $R4=R1$. Particularly, if F1 and F2 are thermal detectors, the thermal fuse parallel circuit here is a thermal detector parallel circuit.

[0056] The equivalent resistance of the parallel circuit is $R1/2$ when the thermal fuse is normal. The equivalent resistance of the parallel circuit is $R1$ when one thermal fuse is abnormal. The equivalent resistance of the parallel circuit is infinity when all thermal fuses are abnormal. This converts the failure situation of the thermal fuses into the equivalent resistance value change of the parallel circuit and further converts it into a voltage value change of V_{in1} corresponding to a first monitoring output V_{out1} and a voltage value change of V_{in2} corresponding to a second monitoring output V_{out2} by a low-voltage datum power supply, thermal fuses F1, F2 and voltage dividing resistors R1, R4, R2 and R3. The failure situation of the thermal fuses may be judged by detecting the voltage values of V_{in1} and V_{in2} .

[0057] The working mechanism is as follows. A first low-voltage datum power supply outputs a low-voltage datum power supply V_{ref_out} to form a loop circuit via the thermal fuses F1, F2, resistors R1, R4, R2, R3, to the ground. The thermal fuse parallel circuit is connected to the resistors R2, R3 orderly in series between the first low-voltage datum power supply and the ground. A first input end in1 of the monitoring and detecting circuit is connected between the thermal fuse parallel circuit and the second resistor R2. A second input end in2 is connected between the second resistor R2 and the third resistor R3. In Figure 2 and Figure 3, the thermal fuse parallel circuit is a circuit connected by F1, F2, R1, R4 (in which $R1=R4$) shown in a dashed line block diagram, and may be made into a small module named thermal detecting single-board and installed on the structure supporting frame via weak wires. The detecting and monitoring circuit has two monitoring output ends that a first monitoring output end out1 and a second monitoring output end out2. The first monitoring output V_{out1} is used to turn off the power supply of the fan. The second monitoring output V_{out2} is used to drive an alarm circuit.

[0058] 1) When the thermal fuses F1, F2 are both normal, $V_{in1} = (R2+R3) \cdot V_{ref_out} / (R1/2+R2+R3)$, $V_{in2} = R3 \cdot V_{ref_out} / (R1/2+R2+R3)$. The first monitoring output V_{out1} and the second monitoring output V_{out2} of the detecting and monitoring circuit are inactive. There is no failure alarm and the fan works normally.

[0059] 2) When one thermal fuse F1 or F2 fails, $V_{in1} = (R2+R3) \cdot V_{ref_out} / (R1+R2+R3)$, $V_{in2} = V_{ref_out} \cdot R3 / (R1+R2+R3)$. The second monitoring output V_{out2} of the detecting and monitoring circuit is active; and the first monitoring output V_{out1} is inactive. There is a failure alarm of and the fan is working normally.

[0060] 3) When the thermal fuses F1 and F2 are both abnormal, $V_{in1}=0$, $V_{in2}=0$. The first monitoring output V_{out1} is active and the second monitoring output V_{out2} is active. There is an alarm and the fan is turned off at the same time.

[0061] It should be pointed out that in Figure 2 and Figure 3, the thermal fuse parallel circuit, i.e. the thermal detecting single-board, is equivalent to a sampling circuit.

[0062] Further details for the solution by a particular realization circuit are as follows:

[0063] As shown in Figure 4, the detecting and monitoring circuit includes hysteresis comparators U1, U2; mode selection comparators U3, U4; XOR gate U5, U6 and transistors Q1 and Q2.

[0064] A positive input end of the first hysteresis comparator U1 is the first input end in1 of the detecting and monitoring circuit connected between the thermal fuse parallel circuit and the second resistor R2. A positive input of the second

hysteresis comparator U2 is the second input in2 of the detecting and monitoring circuit connected between the second resistor R2 and the third resistor R3. The negative input ends of the first hysteresis comparator U1 and the second hysteresis comparator U2 are both connected to a second datum voltage power supply.

[0065] The negative input ends of the first mode selection comparator U3 and the second mode selection comparator U4 are connected to a first datum voltage power supply. The positive input end of the first mode selection comparator U3 is connected to a third datum voltage power supply. The positive input end of the second mode selection comparator U4 is connected to a fourth datum voltage power supply.

[0066] The output ends of the first hysteresis comparator U1 and the first model selection comparator U3 are connected to the input end of the first XOR gate U5. The output ends of the second hysteresis comparator U2 and the second model selection comparator U4 are connected to the input end of the second XOR gate U6.

[0067] The output end of the first XOR gate U5 and the second XOR gate U6 is connected to the base electrodes of the first transistor Q1 and the second transistor Q2 respectively. The emitters of the first transistor Q1 and the second transistor Q2 are connected to the ground, a emitter of the first transistor Q1 is connected to the first monitoring output Vout1, a emitter of the second transistor Q2 is connected to the second monitoring output Vout2;

[0068] In order to realize the technical solution of the present invention, the voltage of the third datum voltage power supply is higher than that of the first datum voltage power supply. The voltage of the fourth datum voltage power supply is lower than that of the first datum voltage power supply. The voltage of the second datum voltage power supply is lower than that of the first datum voltage power supply.

[0069] To descript conveniently and intuitively, the embodiment shown in Figure 4 takes a group of voltages of the low-voltage datum power supply as examples. The voltage Vref_out of the first datum voltage power supply is 2.54V. The voltage of the second datum voltage power supply is 1.27V. The voltage of the third datum voltage power supply is 2.8V. The voltage of the fourth datum voltage power supply is 0.6V. Person in this art should understand that, in practical applications, the voltage of the low-voltage datum power supply may choose other values.

[0070] In Figure 4, a truth table corresponding to the detecting and monitoring circuit is shown in Table 1 below. In the present embodiment, a mode selection signal (mode_select) is connected to a reference power supply 2.54V, which is in conformity with the logic in the dark block. Therefore, the output out1 and the input in1 are logically conformable but the output out2 and the input in2 are logically reversal. The truth table is not going to be described in detail in the present specification. The working process of the detecting and monitoring circuit is analyzed only based on the situation that the mode selection signal (mode_select) is connected to the reference power supply 2.54 V, namely the first datum voltage. The situation that the mode selection signal is connected to other datum voltages has the same analysis principle and won't be described any more.

Table 1 Truth Table of the Detecting and Monitoring Circuit

Mode Selection Signal	in1	out1	in2	out2	Remark
GND	0	0	0	0	channel 1 and channel 2: no reversing
	1	1	1	1	
Vref	0	0	0	1	channel1: no reversing channel2: reversed
	1	1	1	0	
Vcc(>2.0V)	0	1	0	1	channel 1 and channel 2: reversed
	1	0	1	0	

[0071] In Table 1, the channel means a logical relation of out relative to in, i.e. see also the dark block in Table 1, the channel 1 no reversing means out1 relative to in1 is not logically reversed. The channel 2 reversing means out2 relative to in2 is logically reversed.

[0072] As shown in Figure 4, the positive end of the mode selection comparator U3 is connected to a reference voltage 2.8V. The positive end of the mode selection comparator U4 is connected to a reference voltage 0.6V. The comparative output result of U3 is "1" when the mode selection input signal (mode_select) is connected to a reference power supply 2.54 V. The comparative output result of U4 is "0". The output of U1 is "1" when in1 is higher than 1.27 V. By the XOR of the output "1" of U1 and the output "1" of U3, the output of U5 is "0" and the transistor Q1 is cut off. An external pull-up power supply VCC guarantees out1 to be "1". The output of U1 is "0" when in1 is less than 1.27V. By the XOR of the output "0" of U1 and the output "1" of U3, the output of U5 is "1" and the transistor Q1 is on-saturated. The output out1 is "0". U1 has a function of hysteresis which may prevent an uncertain status when in1 is equal to 1.27V. Similarly, the output of U2 is "1" when in2 is higher than 1.27V. By the XOR of the output "1" of U2 and the output "0" of U4, the output of U6 is "1" and the transistor Q2 is on-saturated. The output out2 is "0". The output of U2 is "0" when in2 is lower than 1.27V. By the XOR of the output "0" of U2 and the output "0" of U4, the output of U6 is "0" and the transistor Q2 is cut

off. The external pull-up power supply VCC guarantees the out2 to be "1". U2 has a function of hysteresis which may prevent an uncertain status when in2 is equal to 1.27V.

[0073] As shown in Figure 4, R1, R4, R2, R3 are sampling and voltage dividing resistors and $R1=R4$ and compared with a datum power supply 1.27V after sampling and voltage dividing.

[0074] 1) When thermal fuses F1, F2 are both normal, $V_{in1}=(R2+R3)*V_{ref}/(R1/2+R2+R3)$, $V_{in2}=R3*V_{ref}/(R1/2+R2+R3)$, R1, R2, R3 are assigned values properly to make $V_{in1}>1.27V$ and $V_{in2}>1.27V$. According to Table 2 of the inputs and outputs relation table, the output of the first monitoring output Vout1 is logic "1" indicating that the monitoring is inactive. The follow-up monitored unit works normally. The output of the second monitoring output Vout2 is logic "0". A phototransistor is cut off and the alarm is inactive.

[0075] 2) When thermal fuse F1 or F2 fails, $V_{in1}=(R2+R3)*V_{ref}/(R1+R2+R3)$, $V_{in2}=R3*V_{ref}/(R1+R2+R3)$, R1, R2, R3 are assigned values properly to make $V_{in1}>1.27V$ and $V_{in2}>1.27V$, according to Table 2 of an inputs and outputs relation table, the output of the first monitoring output Vout1 is logic "1" indicating that the monitoring is inactive. The fan works normally. The output of the second monitoring output Vout2 is logic "1". The phototransistor is on and the alarm is active

[0076] 3) When thermal fuses F1 and F2 both fail, $in1=0$, $in2=0$, so $V_{in1}<1.27V$, $V_{in2}<1.27V$. According to Table 2 of an inputs and outputs relation table, the output of the monitoring output Vout1 is logic "0" indicating that the monitoring is active. The fan is turned off. The output of Vout2 is logic "1". The phototransistor is on and the alarm is active.

Table 2 Inputs and Outputs Relation Table

F1	F2	in1	out1	in2	out2
normal	normal	1	1 (monitoring is inactive)	1	0 (alarm is inactive)
failure(open)	normal	1	1 (monitoring is inactive)	0	1 (alarm is active)
normal	failure(open)	1	1 (monitoring is inactive)	0	1 (alarm is active)
failure(open)	failure(open)	0	0 (monitoring is active)	0	1 (alarm is active)

[0077] Method for assigning the values of R1, R2, R3, for example, is as follows:

[0078] 1) To guarantee the in 1 to be 1 when F1 or F2 is fails, what should be satisfied is:

[0079] $V_{in2}=(R2+R3)*2.54/(R1/2+R2+R3)>1.27V$, $(R2+R3)/(R1/2+R2+R3)>0.5$

[0080] 2) To guarantee the in2 to be 1 only when F1 and F2 are both normal, what should be satisfied is:

[0081] $V_{in2}=R3*2.54/(R1/2+R2+R3)>1.27V$, $R3/(R1/2+R2+R3)>0.5$

[0082] Therefore, the assigned values of R1, R2, R3 should satisfy the above two formulas at the same time, for example, $R1=10Kohm$, $R2=4.7Kohm$, $R3=12Kohm$.

[0083] As shown in Figure 4, in the process of normal implementation, the output of the first monitoring output Vout1 is high level when short circuit occurs in the thermal fuse F1 or F2 due to some reasons, for example aging. A relay J1 does not act. A normally closed switch monitored by the relay is closed. The fan is supplied with power by a power supply. The cooling of the system is normal. Vout2 is high level. A second monitoring output (alarm) is active. The system reports a failure alarm of the thermal detecting single-board. A maintainer may correctly judge the failure alarm of the thermal detecting single-board according to the reported alarm information and pull out the inactive thermal detecting single-board. The fan of the system stops rotating due to the complete disconnection of the thermal detecting single-board. Then a good thermal detecting single-board is plugged in. The output of first monitoring output Vout1 is high level. The relay J1 doesn't act. The normally closed switch monitored by the relay is closed. The fan is supplied with power by a power supply and resumes rotating. An alarm information reported by out2 for detecting a failure of the system disappears. Because the replacement for the thermal detecting single-board takes a short time, the fan stops for a short time. The temperature of the system during the process of replacement may not rise greatly. Therefore, the process of replacing the thermal detecting single-board may not affect the normal work of the system. The maintenance process has a better maneuverability and reliability.

[0084] The temperature at the air outlet rises sharply when the system is in fire and the thermal fuses F1, F2 are cut off rapidly because the thermal detecting single-board is installed at the air outlet of the system. The detecting and monitoring circuit outputs alarm information of the thermal detecting single-board and cuts off the power supply of the fan. The combustion of the system decreases the oxygen. The concentration of the carbon dioxide produced by the combustion increases so as to effectively prevent a further internal combustion. At the same time, the internal flame may not be blown out of the equipment by the fan. Therefore, the present technical solution may effectively prevent flames from spreading when combustion occurs.

[0085] The detecting circuit uses a weak datum power supply, as shown in table 3, the output of the datum power supply has an effect of limiting current, without using a strong power supply, for example, a power supply of the fan. A

short circuit with the shell occurs in some part of the thermal detecting single-board when the thermal detecting single-board is operated improperly, an output of great current may not be caused. Therefore, patch plugs, PCB, wires and elements may not be burnt out due to the great current. The system may resume normal running when the failure of short circuit disappears because all the elements are not damaged.

Table 3 Reference Outputs

voltage output ($I_0=0$ mA, $T_A=25$)	Vref	2.48	2.54	2.60	V
load adjust ($I_0=0$ mA ~ 2.0mA)	Reg _{load}	-	0.6	15	mV
wire adjust ($V_{cc}=4.0V \sim 40V$)	Reg _{line}	-	5.0	15	mV
total output change (due to the influence of wires, load, and temperature)	ΔV_{ref}	2.45	-	2.60	V
short circuit current	Isc	-	8.5	30	mA

[0086] As another embodiment, the detecting and monitoring circuit in Figure 2 may also be realized by a discrete voltage comparator.

[0087] Figure 5 illustrates an embodiment which may monitor one or more thermal detecting single-boards by a method of AD converting for monitoring the power supply of the fan. In some large equipments, many overheat protection detecting circuits are needed to be installed in several places. In this case, situations of different detecting points may be sampled by an A/D converting chip. A CPU judges whether to report a failure alarm and whether to turn off the fan or the power supply according to the values sampled from different channels.

[0088] Figure 5 includes several groups of sampling circuits, a detecting and monitoring circuit connected to the sampling circuits and a low-voltage datum power supply. The sampling circuit includes a first thermal fuse F1, a second thermal fuse F2, a first resistor R1, a fifth resistor R2' and a fourth resistor R4. The first thermal fuse F1 is connected to the first resistor R1 in series to form a first branch circuit. The second thermal fuse F2 is connected to the fourth resistor R4 in series to form a second branch circuit. The first branch circuit and the second branch circuit are connected in parallel to form a thermal fuse parallel circuit. The thermal fuse parallel circuit and the fifth resistor R2' are connected in series and connected between the first low-voltage datum power supply and the ground. The detecting and monitoring circuit includes an AD converting chip and a CPU coupled with the AD converting chip. Each input end in1 of the AD converting chip is connected between the thermal fuse parallel circuit of the sampling circuit and the fifth resistor R2' respectively. The CPU monitors the action of the monitored unit via output pins according to the working status of the thermal fuses in each sampling circuit. The monitored unit may include a fan, a power supply of a system, an alarm circuit and so on.

[0089] Figure 6 illustrates another embodiment of the present invention. In the embodiment, the detecting and monitoring circuit may monitor the on-off of the power supply of a system. Similar to the embodiment shown in Figure 4, the voltage value of the datum voltage power supply is illustrative. The present invention is not limited to this concrete value. Other values may also be chosen in applications.

[0090] As illustrated in Figure 6, the input level of the mode selection signal mode_select of the detecting and monitoring circuit is 2.54V when a thermal detecting single-board is used normally. The detecting principle and the monitoring method is the same as the monitoring manner shown in Figure 4. When F1 and F2 on the thermal detecting single-board are normal, inputs of in1 and in2 are higher than 1.27V. The output of out1 is hanged. J1 doesn't act. The output of a power supply of a system is normally closed; out2 is low level, and an alarm output is inactive. When one thermal fuse on the thermal detecting single-board is abnormal due to aging, the input of in1 is higher than 1.27V, the output of out1 is hanged, J1 doesn't act, and the output of the power supply of the system is normally closed; the input of in2 is lower than 1.27V, the output of out2 is high level, the alarm output is active. The power supply relay J 1 acts when two thermal fuses F1 and F2 are open at the same time,. The whole system (including the power supply of the fan) is power-down, which makes the fan of the equipment stop running and cuts off the thermal source caused by the power supply, a combustion spreading is prevented effectively.

[0091] In this embodiment, the mode selection signal mode_select of the detecting and monitoring circuit is pulled up to the status of VCC by a sixth resistor R5 when the thermal detecting single-board is off-duty. The inputs of in1 and in2 are low level. According to the truth table illustrated in Table 4(shown in the dark block), the first monitoring output Vout1 is in the state of 1. The power supply relay J1 keeps in the normally closed state. The system keeps an output of power supply. The second monitoring output Vout2 is in the status of 1 because the thermal detecting single-board is off-duty, and an alarm output reported by an alarm circuit is active.

Table 4

mode selection signal	in1	out1	in2	out2	comments
GND	0	0	0	0	channel 1 and channel 2: no reversing
	1	1	1	1	
Vref	0	0	0	1	channel 1: no reversing channel 2: reversed
	1	1	1	0	
Vcc(>2.0V)	0	1	0	1	channel 1 and channel 2: reversed
	1	0	1	0	

[0092] The maintainer may judge an alarm of the failure of the thermal detecting single-board correctly by the reported alarm information when one thermal fuse on the thermal detecting single-board fails due to some reasons, for example, aging, and pull out the disabled thermal detecting single-board. The thermal detecting single-board is completely cut off. The thermal detecting single-board is off-duty. The system keeps an output of power supply. The output of the first monitoring output Vout1 is that the monitoring is inactive when a good thermal detecting single-board is plugged in and detected by the system via the detecting and monitoring circuit. The power supply keeps an output. An alarm information reported by a second monitoring output out2 for detecting a failure of the system disappears. In addition, the thermal detecting single-board may only be provided with thermal fuses F1 and F2. The resistors R1 and R4 are fixed and connected in the circuit. In all the above embodiments, a sampling circuit including two thermal fuses F1 and F2 is taken as an example. In practical application, the number of the thermal fuses may be more than two.

[0093] In addition, the design of connecting a delay driving circuit in series between the first monitoring output end out1 and the power supply relay J1 is adapted for eliminating the influence of possible dithering in an uncertain status emerging during a process of plugging and pulling a board, i.e. hot plug so that a power-down may not occur in a system during the normal using and maintaining, which guarantees a maintainability and liability of the using of the system.

[0094] The above-mentioned thermal fuse includes an electronic element whose on-off changes with the change of temperature, for example, a thermal fuse and a thermal relay.

[0095] For the element whose on-off changes with the change of temperature, the normal status is that the element is in the state of on. The abnormal status is that the element fails, i.e. the connection is cut off. For the element whose resistance value changes greatly with the change of temperature. If the element is in the state of standard resistance value, the element is at a normal status. If the resistance value is too high or too low, i.e. deviates quite far from the standard value, the element is in an abnormal state.

[0096] Though illustration and description of the present disclosure have been given with reference to the embodiments thereof, it should be appreciated by persons of ordinary skill in the art that various changes in forms and details can be made without deviation from the scope of this disclosure, which are defined by the appended claims.

Claims

1. A device for preventing internal combustion in an electronic equipment from spreading outwards, comprising a sampling circuit, a detecting and monitoring circuit connected to the sampling circuit and a low-voltage datum power supply; wherein the output of the low-voltage datum power supply is connected to the ground via the sampling circuit to form a loop circuit; the sampling circuit comprises at least two thermal detectors, the detecting and monitoring circuit comprises a first monitoring output end (out1) and a second monitoring output end (out2), the detecting and monitoring circuit monitors the output of the first monitoring output end (out1) and the second monitoring output end (out2) according to the working status of the thermal detectors as follows:

the first monitoring output (Vout1) is inactive and the second monitoring output (Vout2) is inactive when the at least two thermal detectors are in normal status;
the first monitoring output (Vout1) is inactive and the second monitoring output (Vout2) is active when some of the at least two thermal detectors are in abnormal status;
the first monitoring output (Vout1) is active and the second monitoring output (Vout2) is active when the at least two thermal detectors are all in abnormal status;
the first monitoring output (Vout1) is configured to turn off a power supply, and the second monitoring output (Vout2) is configured to drive an alarm unit;

wherein the sampling circuit comprises a first thermal detector (F1), a second thermal detector (F2), a first resistor (R1), a second resistor (R2), a third resistor (R3) and a fourth resistor (R4);
the first thermal detector (F1) and the first resistor (R1) are connected in series to form a first branch circuit, the
second thermal detector (F2) and the fourth resistor (R4) are connected in series to form a second branch
circuit, the first branch circuit and the second branch circuit are connected in parallel to form a thermal detector
parallel circuit; the thermal detector parallel circuit is connected to the second resistor (R2) and the third resistor
(R3) orderly in series between the low-voltage datum power supply and the ground;
wherein the detecting and monitoring circuit comprises a first input end (in1) and a second input end (in2);
the first input end (in1) of the detecting and monitoring circuit is connected between the thermal detector parallel
circuit and the second resistor (R2); and
the second input end (in2) is connected between the second resistor (R2) and the third resistor (R3).

2. The device according to claim 1, wherein the detecting and monitoring circuit is realized by an integrated voltage comparator or a discrete voltage comparator.
3. The device according to claim 1, wherein the sampling circuit comprises a first thermal detector (F1), a second thermal detector (F2), a first resistor (R1), a fifth resistor (R2') and a fourth resistors (R4); wherein the first thermal detector (F1) and the first resistor (R1) are connected in series to form a first branch circuit; the second thermal detector (F2) and the fourth resistor (R4) are connected in series to form a second branch circuit; the first branch circuit and the second branch circuit are connected in parallel to form a thermal detector parallel circuit; and the thermal detector parallel circuit and the fifth resistor (R2') are connected in series between the low-voltage datum power supply and the ground.
4. The device according to claim 3, wherein the detecting and monitoring circuit comprises an analog-to-digital AD converting chip and a CPU coupled with the AD converting chip; wherein an input end (in1) of the AD converting chip is connected between the thermal detector parallel circuit of the sampling circuit and the fifth resistor (R2'); one output pin on the CPU is a first monitoring output end; another output pin on the CPU is a second monitoring output end.
5. The device according to any one of claims 1-4, wherein the thermal detector in the sampling circuit is installed on a thermal detecting single-board and the thermal detecting single-board is installed in the device in a manner of hot plug.
6. The device according to claim 5, wherein the device further comprises a pull-up resistor configured to pull a mode selection signal in the detecting and monitoring circuit up to the status of a power supply VCC so as to make the first monitoring output (Vout1) inactive and the second monitoring output (Vout2) active when the thermal detecting single-board is off-duty.
7. The device according to claim 6, wherein the device further comprises a delay driving circuit connected behind the first monitoring output end in series and configured to eliminate the status of dithering occurred during swapping and plugging the thermal detecting single-board.
8. The device according to any one of claims 1- 4, wherein the thermal detector is an element whose on-off changes with the change of temperature, or an element whose resistance value changes greatly with the change of temperature.
9. The device according to claim 1, wherein the power supply comprises: a power supply of a fan or a power supply of a system and a fan.
10. A device for preventing internal combustion in an electronic equipment from spreading outwards, comprising at least two sampling circuits, a detecting and monitoring circuit and a low-voltage datum power supply which are connected to each of the sampling circuits respectively; wherein an output of the low-voltage datum power supply is connected to the ground via each of the sampling circuits respectively to form a loop circuit with each of the sampling circuits independently; each of the sampling circuits comprises at least two thermal detectors; the detecting and monitoring circuit comprises a first monitoring output end (out1) and a second monitoring output end (out2); and

the detecting and monitoring circuit monitors the output of the first monitoring output end (Vout1) and the second monitoring output end (out2) according to the working status of the thermal detector in each of the sampling circuits as follows:

the first monitoring output (Vout1) is inactive and the second monitoring output (Vout2) is inactive when the thermal detectors in the device are all in normal status;
 the first monitoring output (Vout1) is inactive and the second monitoring output (Vout2) is active when some of the thermal detectors in the device are in abnormal status and at least one thermal detector in each of the sampling circuits is normal;
 the first monitoring output (Vout1) is active and the second monitoring output (Vout2) is active when all the thermal detectors in at least one sampling circuit are in abnormal status;
 the first monitoring output (Vout1) is configured to cut off the power supply, and the second monitoring output (Vout2) is configured to drive an alarm unit;
 wherein the sampling circuit comprises a first thermal detector (F1), a second thermal detector (F2), a first resistor (R1), a fifth resistor (R2') and a fourth resistors (R4); the first thermal detector (F1) and the first resistor (R1) are connected in series to form a first branch circuit, the second thermal detector (F2) and the fourth resistor (R4) are connected in series to form a second branch circuit, the first branch circuit and the second branch circuit are connected in parallel to form a thermal detector parallel circuit, and the thermal detector parallel circuit and the fifth resistor (R2') are connected in series between the low-voltage datum power supply and the ground.

11. The device according to claim 10, wherein the detecting and monitoring circuit comprises an analog-to-digital AD converting chip and a CPU coupled with the AD converting chip; wherein each input end (in1) of the AD converting chip is connected between the thermal detector parallel circuit of each of the sampling circuits and the fifth resistor (R2') respectively, one output pin on the CPU being a first monitoring output end, another output pin on the CPU being a second monitoring output end.
12. The device according to claim 10, wherein the thermal detector parallel circuit is installed on a thermal detecting single-board, the thermal detecting single-board is installed in the device in a manner of hot plug.
13. The device according to claim 12, wherein the device further comprises a pull-up resistor configured to pull a mode selection signal in the detecting and monitoring circuit up to the status of a power supply VCC so as to make the first monitoring output (Vout1) inactive and the second monitoring output (Vout2) active when the thermal detecting single-board is off-duty.
14. The device according to claim 13, wherein the device further comprises a delay driving circuit connected behind the first monitoring output end in series and configured to eliminate the status of dithering occurred during swapping and plugging the thermal detecting single-board.
15. The device according to any one of claims 10-11, wherein the thermal detector is an element whose on-off changes with the change of temperature, or an element whose resistance value changes greatly with the change of temperature.
16. The device according to claim 10, wherein the power supply comprises: a power supply of a fan or a power supply of a system and a fan.

Patentansprüche

1. Einrichtung zum Verhindern der Ausbreitung eines internen Brands in einem elektronischen Gerät nach außen mit einer Abtastschaltung, einer mit der Abtastschaltung und einer Niederspannungs-Datum-Stromversorgung verbundenen Detektions- und Überwachungsschaltung; wobei der Ausgang der Niederspannungs-Datum-Stromversorgung über die Abtastschaltung mit der Masse verbunden ist, um eine Schleifenschaltung zu bilden;
 die Abtastschaltung mindestens zwei thermische Detektoren umfasst, die Detektions- und Überwachungsschaltung ein erstes Überwachungsausgabeende (out1) und ein zweites Überwachungsausgabeende (out2) umfasst, die Detektions- und Überwachungsschaltung den Ausgang des ersten Überwachungsausgabeendes (out1) und des zweiten Überwachungsausgabeendes (out2) gemäß dem Arbeitsstatus der thermischen Detektoren folgendermaßen überwacht:

der erste Überwachungsausgang (Vout1) ist inaktiv und der zweite Überwachungsausgang (Vout2) ist inaktiv, wenn sich die mindestens zwei thermischen Detektoren in einem normalen Status befinden;
 der erste Überwachungsausgang (Vout1) ist inaktiv und der zweite Überwachungsausgang (Vout2) ist aktiv, wenn sich bestimmte der mindestens zwei thermischen Detektoren in einem abnormen Status befinden;
 der erste Überwachungsausgang (Vout1) ist aktiv und der zweite Überwachungsausgang (Vout2) ist aktiv, wenn sich die mindestens zwei thermischen Detektoren alle in einem abnormen Status befinden;
 der erste Überwachungsausgang (Vout1) ist dafür ausgelegt, eine Stromversorgung auszuschalten, und der zweite Überwachungsausgang (Vout2) ist dafür ausgelegt, eine Alarmeinheit anzusteuern;
 wobei die Abtastschaltung einen ersten thermischen Detektor (F1), einen zweiten thermischen Detektor (F2), einen ersten Widerstand (R1), einen zweiten Widerstand (R2), einen dritten Widerstand (R3) und einen vierten Widerstand (R4) umfasst;
 der erste thermische Detektor (F1) und der erste Widerstand (R1) in Reihe geschaltet sind, um eine erste Zweigschaltung zu bilden, der zweite thermische Detektor (F2) und der vierte Widerstand (R4) in Reihe geschaltet sind, um eine zweite Zweigschaltung zu bilden, die erste Zweigschaltung und die zweite Zweigschaltung parallel geschaltet sind, um eine Parallelschaltung thermischer Detektoren zu bilden; die Parallelschaltung thermischer Detektoren mit dem zweiten Widerstand (R2) und dem dritten Widerstand (R3) ordentlich zwischen der Niederspannungs-Datum-Stromversorgung und der Masse in Reihe geschaltet sind;
 wobei die Detektions- und Überwachungsschaltung ein erstes Eingabeende (in1) und ein zweites Eingabeende (in2) umfasst:

das erste Eingabeende (in1) der Detektions- und Überwachungsschaltung zwischen die Parallelschaltung thermischer Detektoren und den zweiten Widerstand (R2) geschaltet ist; und
 das zweite Eingabeende (in2) zwischen den zweiten Widerstand (R2) und den dritten Widerstand (R3) geschaltet ist.

2. Einrichtung nach Anspruch 1, wobei die Detektions- und Überwachungsschaltung durch einen integrierten Spannungskomparator oder einen diskreten Spannungskomparator realisiert ist.
3. Einrichtung nach Anspruch 1, wobei die Abtastschaltung einen ersten thermischen Detektor (F1), einen zweiten thermischen Detektor (F2), einen ersten Widerstand (R1), einen fünften Widerstand (R2') und einen vierten Widerstand (R4) umfasst; wobei
 der erste thermische Detektor (F1) und der erste Widerstand (R1) in Reihe geschaltet sind, um eine erste Zweigschaltung zu bilden; der zweite thermische Detektor (F2) und der vierte Widerstand (R4) in Reihe geschaltet sind, um eine zweite Zweigschaltung zu bilden; die erste Zweigschaltung und die zweite Zweigschaltung parallel geschaltet sind, um eine Parallelschaltung thermischer Detektoren zu bilden; und
 die Parallelschaltung thermischer Detektoren und der fünfte Widerstand (R2') zwischen der Niederspannungs-Datum-Stromversorgung und der Masse in Reihe geschaltet sind.
4. Einrichtung nach Anspruch 3, wobei die Detektions- und Überwachungsschaltung einen Analog-Digital-AD-Umsetzungschip und eine mit dem AD-Umsetzungschip gekoppelte CPU umfasst; wobei
 ein Eingabeende (in1) des AD-Umsetzungschips zwischen die Parallelschaltung thermischer Detektoren der Abtastschaltung und den fünften Widerstand (R2') geschaltet ist; ein Ausgangsanschluss an der CPU ein erstes Überwachungsausgabeende ist; ein anderer Ausgangsanschluss an der CPU ein zweites Überwachungsausgabeende ist.
5. Einrichtung nach einem der Ansprüche 1-4, wobei der thermische Detektor in der Abtastschaltung auf einer Einzelleiterplatte zur thermischen Detektion installiert ist und die Einzelleiterplatte zur thermischen Detektion in der Einrichtung auf eine Hot-Plug-Weise installiert ist.
6. Einrichtung nach Anspruch 5, wobei die Einrichtung ferner einen Pullup-Widerstand umfasst, der dafür ausgelegt ist, ein Modusauswahlsignal in der Detektions- und Überwachungsschaltung auf den Status eines Stromversorgungs-VCC heraufzuziehen, um so den ersten Überwachungsausgang (Vout1) inaktiv und den zweiten Überwachungsausgang (Vout2) aktiv zu machen, wenn die Einzelleiterplatte zur thermischen Detektion außer Dienst ist.
7. Einrichtung nach Anspruch 6, wobei die Einrichtung ferner eine hinter dem ersten Überwachungsausgabeende in Reihe geschaltete Verzögerungsansteuerschaltung umfasst, die dafür ausgelegt ist, den während des Umwechsellns und Einsteckens der Einzelleiterplatte zur thermischen Detektion aufgetretenen Status des Ditherns zu beseitigen.

8. Einrichtung nach einem der Ansprüche 1-4, wobei der thermische Detektor ein Element ist, dessen Ein-Aus sich mit der Temperaturänderung ändert, oder ein Element, dessen Widerstandswert sich stark mit der Temperaturänderung ändert.
- 5 9. Einrichtung nach Anspruch 1, wobei die Stromversorgung Folgendes umfasst: eine Stromversorgung eines Lüfters oder eine Stromversorgung eines Systems und eines Lüfters.
- 10 10. Einrichtung zum Verhindern der Ausbreitung eines internen Brands in einem elektronischen Gerät nach außen mit mindestens zwei Abtastschaltungen, einer Detektions- und Überwachungsschaltung und einer Niederspannungs-Datum-Stromversorgung, die jeweils mit jeder der Abtastschaltungen verbunden sind, wobei
10 ein Ausgang der Niederspannungs-Datum-Stromversorgung über jede der Abtastschaltungen mit der Masse verbunden ist, um jeweils unabhängig eine Schleifenschaltung mit jeder der Abtastschaltungen zu bilden;
jede der Abtastschaltungen mindestens zwei thermische Detektoren umfasst;
15 die Detektions- und Überwachungsschaltung ein erstes Überwachungsausgabeende (out1) und ein zweites Überwachungsausgabeende (out2) umfasst; und
die Detektions- und Überwachungsschaltung den Ausgang des ersten Überwachungsausgabeendes (out1) und des zweiten Überwachungsausgabeendes (out2) gemäß dem Arbeitsstatus des thermischen Detektors in jeder der Abtastschaltungen folgendermaßen überwacht:
20 der erste Überwachungsausgang (Vout1) ist inaktiv und der zweite Überwachungsausgang (Vout2) ist inaktiv, wenn sich die thermischen Detektoren in der Einrichtung alle in einem normalen Status befinden;
der erste Überwachungsausgang (Vout1) ist inaktiv und der zweite Überwachungsausgang (Vout2) ist aktiv, wenn sich bestimmte der thermischen Detektoren in der Einrichtung in einem abnormen Status befinden und
mindestens ein thermischer Detektor in jeder der Abtastschaltungen normal ist;
25 der erste Überwachungsausgang (Vout1) ist aktiv und der zweite Überwachungsausgang (Vout2) ist aktiv, wenn sich alle thermischen Detektoren in mindestens einer Abtastschaltung in einem abnormen Status befinden;
der erste Überwachungsausgang (Vout1) ist dafür ausgelegt, die Stromversorgung abzuschalten, und der zweite Überwachungsausgang (Vout2) ist dafür ausgelegt, eine Alarmeinheit anzusteuern;
30 wobei die Abtastschaltung einen ersten thermischen Detektor (F1), einen zweiten thermischen Detektor (F2), einen ersten Widerstand (R1), einen fünften Widerstand (R2') und einen vierten Widerstand (R4) umfasst; wobei der erste thermische Detektor (F1) und der erste Widerstand (R1) in Reihe geschaltet sind, um eine erste Zweigschaltung zu bilden, der zweite thermische Detektor (F2) und der vierte Widerstand (R4) in Reihe geschaltet sind, um eine zweite Zweigschaltung zu bilden, die erste Zweigschaltung und die zweite Zweigschaltung parallel geschaltet sind, um eine Parallelschaltung thermischer Detektoren zu bilden, und die Parallelschaltung
35 thermischer Detektoren und der fünfte Widerstand (R2') zwischen der Niederspannungs-Datum-Stromversorgung und der Masse in Reihe geschaltet sind.
11. Einrichtung nach Anspruch 10, wobei die Detektions- und Überwachungsschaltung einen Analog-Digital-AD-Umsetzungschip und eine mit dem AD-Umsetzungschip gekoppelte CPU umfasst; wobei
40 jedes Eingabeende (in1) des AD-Umsetzungschips jeweils zwischen die Parallelschaltung thermischer Detektoren jeder der Abtastschaltungen und den fünften Widerstand (R2') geschaltet ist, wobei ein Ausgangsanschluss an der CPU ein erstes Überwachungsausgabeende und ein anderer Ausgangsanschluss an der CPU ein zweites Überwachungsausgabeende ist.
- 45 12. Einrichtung nach Anspruch 10, wobei die Parallelschaltung thermischer Detektoren auf einer Einzelleiterplatte zur thermischen Detektion installiert ist und die Einzelleiterplatte zur thermischen Detektion in der Einrichtung auf eine Hot-Plug-Weise installiert ist.
13. Einrichtung nach Anspruch 12, wobei die Einrichtung ferner einen Pullup-Widerstand umfasst, der dafür ausgelegt
50 ist, ein Modusauswahlsignal in der Detektions- und Überwachungsschaltung auf den Status einer Stromversorgungs-VCC heraufzuziehen, um so den ersten Überwachungsausgang (Vout1) inaktiv und den zweiten Überwachungsausgang (Vout2) aktiv zu machen, wenn die Einzelleiterplatte zur thermischen Detektion außer Dienst ist.
14. Einrichtung nach Anspruch 13, wobei die Einrichtung ferner eine hinter dem ersten Überwachungsausgabeende in
55 Reihe geschaltete Verzögerungsansteuerschaltung umfasst, die dafür ausgelegt ist, den während des Umwechsellns und Einsteckens der Einzelleiterplatte zur thermischen Detektion aufgetretenen Status des Ditherns zu beseitigen.
15. Einrichtung nach einem der Ansprüche 10-11, wobei der thermische Detektor ein Element ist, dessen Ein-Aus sich

mit der Temperaturänderung ändert, oder ein Element, dessen Widerstandswert sich stark mit der Temperaturänderung ändert.

16. Einrichtung nach Anspruch 10, wobei die Stromversorgung Folgendes umfasst: eine Stromversorgung eines Lüfters oder eine Stromversorgung eines Systems und eines Lüfters.

Revendications

1. Dispositif destiné à empêcher une combustion interne dans un équipement électronique de se propager vers l'extérieur, comportant un circuit d'échantillonnage, un circuit de détection et de surveillance relié au circuit d'échantillonnage et une alimentation basse tension de référence ;
la sortie de l'alimentation basse tension de référence étant reliée à la terre via le circuit d'échantillonnage pour former un circuit en boucle ;
le circuit d'échantillonnage comportant au moins deux détecteurs thermiques, le circuit de détection et de surveillance comportant une première extrémité de sortie de surveillance (out1) et une deuxième extrémité de sortie de surveillance (out2), le circuit de détection et de surveillance surveillant la sortie de la première extrémité de sortie de surveillance (out1) et la deuxième extrémité de sortie de surveillance (out2) en fonction de l'état de fonctionnement des détecteurs thermiques comme suit :

la première sortie de surveillance (Vout1) est inactive et la deuxième sortie de surveillance (Vout2) est inactive lorsque lesdits au moins deux détecteurs thermiques sont dans leur état normal ;

la première sortie de surveillance (Vout1) est inactive et la deuxième sortie de surveillance (Vout2) est active lorsqu'une partie desdits au moins deux détecteurs thermiques sont dans un état anormal ;

la première sortie de surveillance (Vout1) est active et la deuxième sortie de surveillance (Vout2) est active lorsque lesdits au moins deux détecteurs thermiques sont tous dans un état anormal ;

la première sortie de surveillance (Vout1) est configurée pour couper une alimentation et la deuxième sortie de surveillance (Vout2) est configurée pour actionner une unité d'alarme ;

le circuit d'échantillonnage comportant un premier détecteur thermique (F1), un deuxième détecteur thermique (F2), une première résistance (R1), une deuxième résistance (R2), une troisième résistance (R3) et une quatrième résistance (R4) ;

le premier détecteur thermique (F1) et la première résistance (R1) étant reliés en série pour former un premier circuit de branche, le deuxième détecteur thermique (F2) et la quatrième résistance (R4) étant reliés en série pour former un deuxième circuit de branche, le premier circuit de branche et le deuxième circuit de branche étant reliés en parallèle pour former un circuit parallèle de détecteurs thermiques le circuit parallèle de détecteurs thermiques étant relié à la deuxième résistance (R2) et à la troisième résistance (R3) de façon ordonnée en série entre l'alimentation basse tension de référence et la terre ;

le circuit de détection et de surveillance comportant une première extrémité d'entrée (in1) et une deuxième extrémité d'entrée (in2) ;

la première extrémité d'entrée (in1) du circuit de détection et de surveillance étant branchée entre le circuit parallèle de détecteurs thermiques et la deuxième résistance (R2) ; et

la deuxième extrémité d'entrée (in2) étant branchée entre la deuxième résistance (R2) et la troisième résistance (R3).

2. Dispositif selon la revendication 1, le circuit de détection et de surveillance étant réalisé par un comparateur de tension intégré ou un comparateur de tension discret.

3. Dispositif selon la revendication 1, le circuit d'échantillonnage comportant un premier détecteur thermique (F1), un deuxième détecteur thermique (F2), une première résistance (R1), une cinquième résistance (R2') et une quatrième résistance (R4) ;

le premier détecteur thermique (F1) et la première résistance (R1) étant reliés en série pour former un premier circuit de branche ; le deuxième détecteur thermique (F2) et la quatrième résistance (R4) étant reliés en série pour former un deuxième circuit de branche ; le premier circuit de branche et le deuxième circuit de branche étant reliés en parallèle pour former un circuit parallèle de détecteurs thermiques ; et

le circuit parallèle de détecteurs thermiques et la cinquième résistance (R2') étant reliés en série entre l'alimentation basse tension de référence et la terre.

4. Dispositif selon la revendication 3, le circuit de détection et de surveillance comportant une puce de conversion

analogique-numérique AD et une CPU couplée à la puce de conversion AD ;
une extrémité d'entrée (in1) de la puce de conversion AD étant branchée entre le circuit parallèle de détecteurs thermiques du circuit d'échantillonnage et la cinquième résistance (R2') ; une broche de sortie de la CPU étant une première extrémité de sortie de surveillance ; une autre broche de sortie de la CPU étant une deuxième extrémité de sortie de surveillance.

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5. Dispositif selon l'une quelconque des revendications 1 à 4, le détecteur thermique du circuit d'échantillonnage étant installé sur une monocarte de détection thermique et la monocarte de détection thermique étant installée dans le dispositif par connexion à chaud.

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6. Dispositif selon la revendication 5, le dispositif comportant en outre une résistance de rappel vers le haut configurée pour rehausser un signal de sélection de mode dans le circuit de détection et de surveillance jusqu'au niveau d'une alimentation VCC de façon à rendre la première sortie de surveillance (Vout1) inactive et la deuxième sortie de surveillance (Vout2) active lorsque la monocarte de détection thermique n'est pas en service.

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7. Dispositif selon la revendication 6, le dispositif comportant en outre un circuit de pilotage de retard branché en série derrière la première extrémité de sortie de surveillance et configuré pour éliminer l'état de juxtaposition qui survient lorsque l'on permute et connecte la monocarte de détection thermique.

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8. Dispositif selon l'une quelconque des revendications 1 à 4, le détecteur thermique étant un élément dont l'état marche-arrêt change avec la variation de la température, ou un élément dont la valeur de la résistance varie considérablement avec la variation de la température.

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9. Dispositif selon la revendication 1, l'alimentation comportant : une alimentation de ventilateur ou une alimentation d'un système et d'un ventilateur.

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10. Dispositif destiné à empêcher une combustion interne dans un équipement électronique de se propager vers l'extérieur, comportant au moins deux circuits d'échantillonnage, un circuit de détection et de surveillance et une alimentation basse tension de référence reliés respectivement à chacun des circuits d'échantillonnage ; une sortie de l'alimentation basse tension de référence étant reliée à la terre via chacun des circuits d'échantillonnage respectivement pour former indépendamment un circuit en boucle avec chacun des circuits d'échantillonnage ;
chacun des circuits d'échantillonnage comportant au moins deux détecteurs thermiques ;
le circuit de détection et de surveillance comportant une première extrémité de sortie de surveillance (out1) et une deuxième extrémité de sortie de surveillance (out2) ; et le circuit de détection et de surveillance surveillant la sortie de la première extrémité de sortie de surveillance (out1) et de la deuxième extrémité de sortie de surveillance (out2) en fonction de l'état de fonctionnement du détecteur thermique dans chacun des circuits d'échantillonnage comme suit :

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la première sortie de surveillance (Vout1) est inactive et la deuxième sortie de surveillance (Vout2) est inactive lorsque les détecteurs thermiques du dispositif sont tous dans leur état normal ;

la première sortie de surveillance (Vout1) est inactive et la deuxième sortie de surveillance (Vout2) est active lorsque certains des détecteurs thermiques du dispositif sont dans un état anormal et au moins un détecteur thermique dans chacun des circuits d'échantillonnage est normal ;

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la première sortie de surveillance (Vout1) est active et la deuxième sortie de surveillance (Vout2) est active lorsque tous les détecteurs thermiques dans au moins un circuit d'échantillonnage sont dans un état anormal ; la première sortie de surveillance (Vout1) est configurée pour couper l'alimentation et la deuxième sortie de surveillance (Vout2) est configurée pour actionner une unité d'alarme ;

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le circuit d'échantillonnage comportant un premier détecteur thermique (F1), un deuxième détecteur thermique (F2), une première résistance (R1), une cinquième résistance (R2') et une quatrième résistance (R4) ; le premier détecteur thermique (F1) et la première résistance (R1) étant reliés en série pour former un premier circuit de branche, le deuxième détecteur thermique (F2) et la quatrième résistance (R4) étant reliés en série pour former un deuxième circuit de branche, le premier circuit de branche et le deuxième circuit de branche étant reliés en parallèle pour former un circuit parallèle de détecteurs thermiques, et le circuit parallèle de détecteurs thermiques et la cinquième résistance (R2') étant reliés en série entre l'alimentation basse tension de référence et la terre.

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11. Dispositif selon la revendication 10, le circuit de détection et de surveillance comportant une puce de conversion analogique-numérique AD et une CPU couplée à la puce de conversion AD ;
chaque extrémité d'entrée (in1) de la puce de conversion AD étant branchée respectivement entre le circuit parallèle

de détecteurs thermiques de chacun des circuits d'échantillonnage et la cinquième résistance (R2'), une broche de sortie de la CPU étant une première extrémité de sortie de surveillance, une autre broche de sortie de la CPU étant une deuxième extrémité de sortie de surveillance.

- 5 **12.** Dispositif selon la revendication 10, le circuit parallèle de détecteurs thermiques étant installé sur une monocarte de détection thermique et la monocarte de détection thermique étant installée dans le dispositif par connexion à chaud.
- 10 **13.** Dispositif selon la revendication 12, le dispositif comportant en outre une résistance de rappel vers le haut configurée pour rehausser un signal de sélection de mode dans le circuit de détection et de surveillance jusqu'au niveau d'une alimentation VCC de façon à rendre la première sortie de surveillance (Vout1) inactive et la deuxième sortie de surveillance (Vout2) active lorsque la monocarte de détection thermique n'est pas en service.
- 15 **14.** Dispositif selon la revendication 13, le dispositif comportant en outre un circuit de pilotage de retard branché en série derrière la première extrémité de sortie de surveillance et configuré pour éliminer l'état de juxtaposition qui survient lorsque l'on permute et connecte la monocarte de détection thermique.
- 20 **15.** Dispositif selon l'une quelconque des revendications 10 et 11, le détecteur thermique étant un élément dont l'état marche-arrêt change avec la variation de la température, ou un élément dont la valeur de la résistance varie considérablement avec la variation de la température.
- 25 **16.** Dispositif selon la revendication 10, l'alimentation comportant : une alimentation de ventilateur ou une alimentation d'un système et d'un ventilateur.

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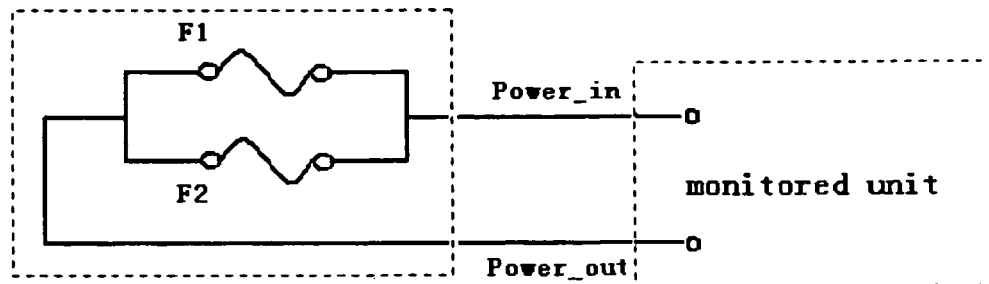


Figure 1

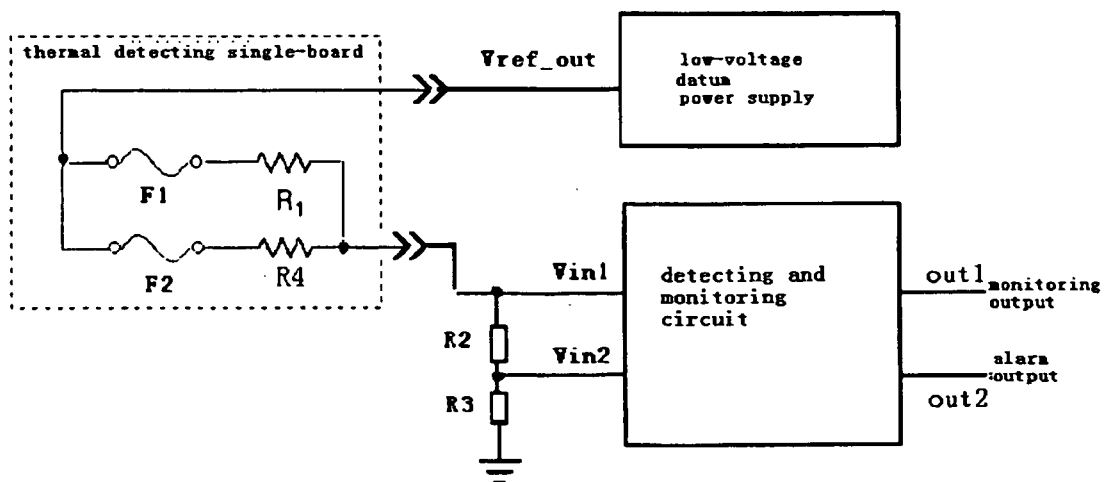


Figure 2

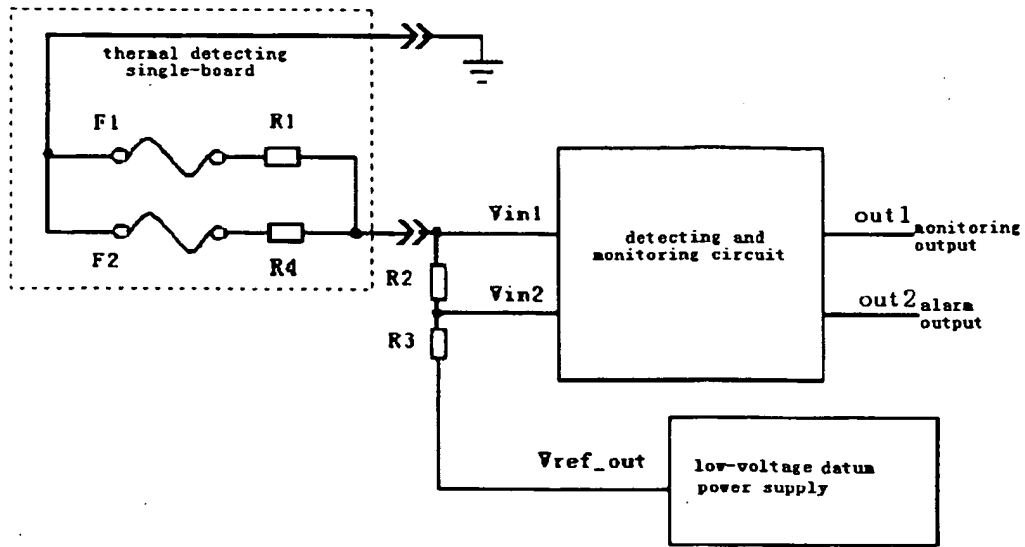


Figure 3

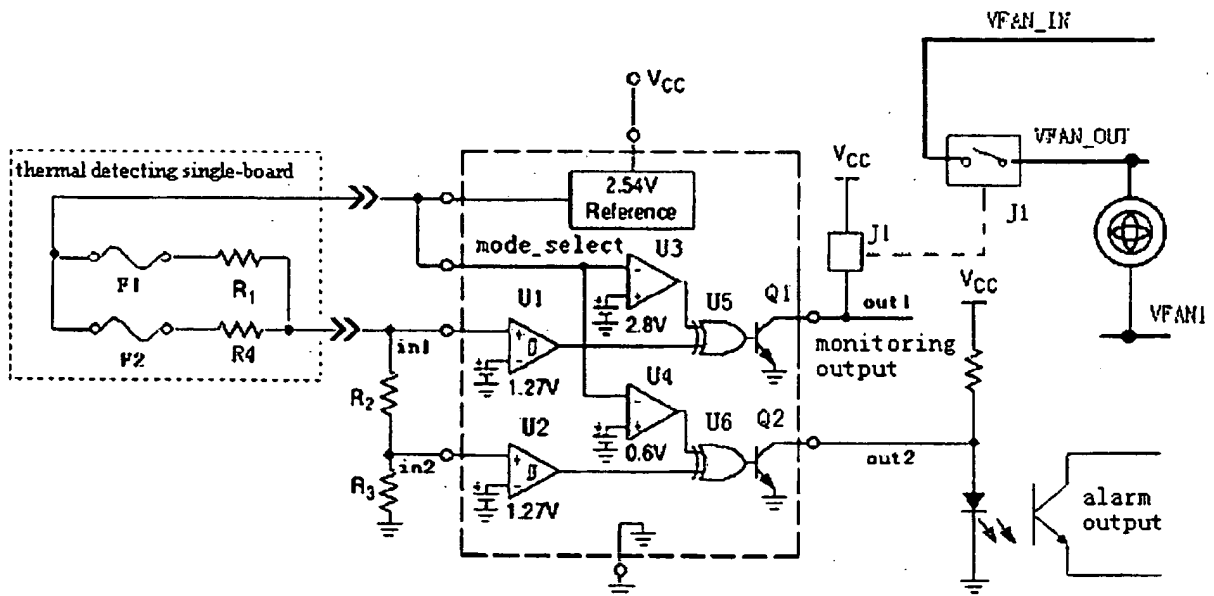


Figure 4

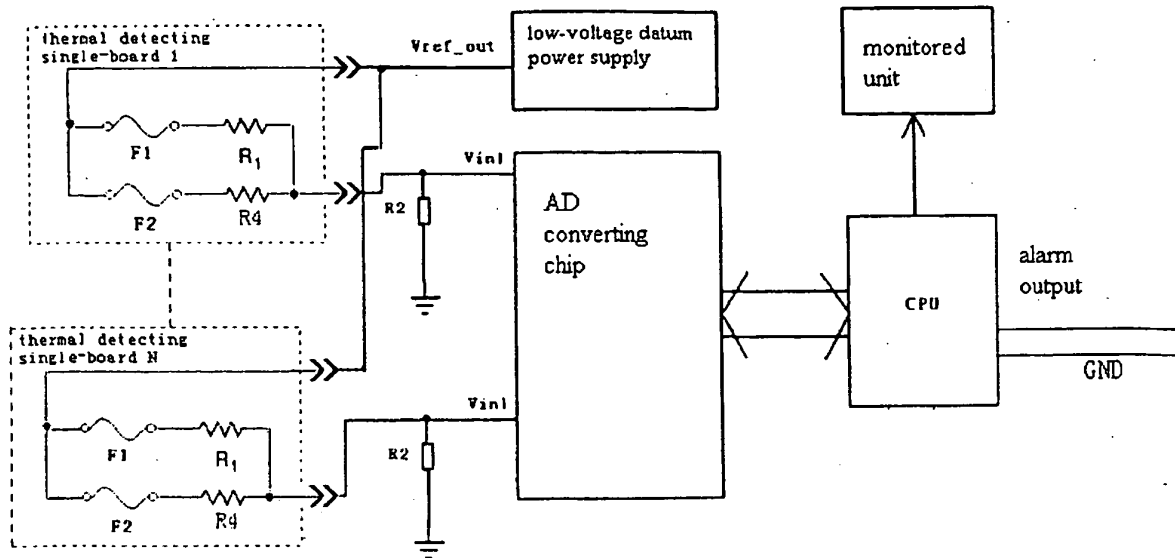


Figure 5

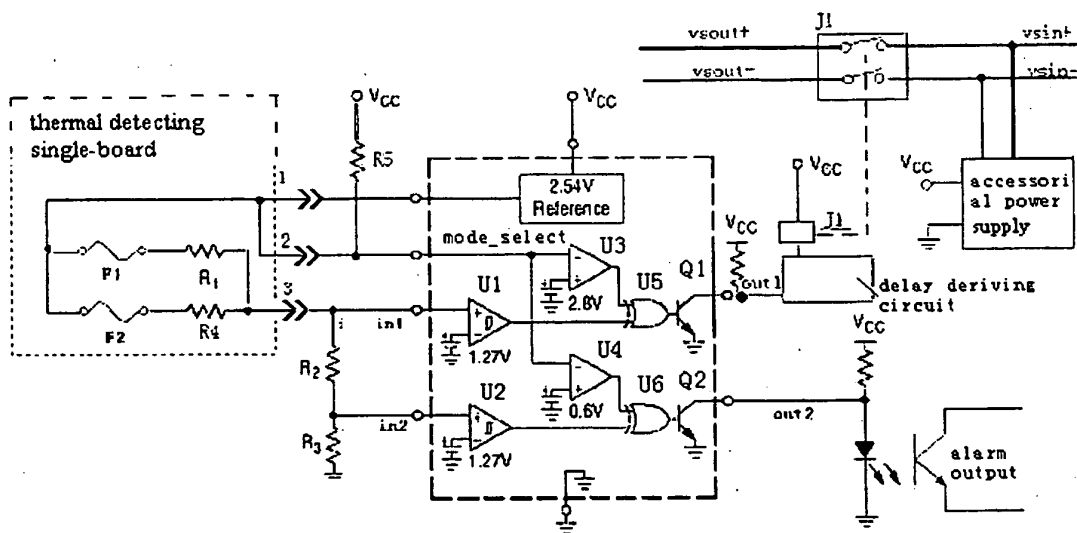


Figure 6

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 6072397 A [0004]
- US 5079542 A [0004]
- WO 2005087898 A [0004]